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ABSTRACT

Based on the concept that library use measurement should have as its basic starting point the individual patron, a method of data collection and analysis has been developed that explores individual patterns of borrowing over time. The method accounts for the number of visits on which borrowing takes place, number of items borrowed per visit, and total items borrowed over time, and it relates these to personal characteristics such as gender and distance of residence from the library. Four "core groups" can be identified from this analysis: core borrowers, heavy visitors, heavy borrowers, and light users. The study of individual user patterns results in a variety of potential applications for library decision making, such as a revised look at reciprocal borrowing policy, new knowledge of patron characteristics in relation to library use, and more information on the proportion of community residents who borrow, the variations in use patterns by day of the week, and the use of multiple units in the same library system. This publication describes the basic principles of individual use measurement, methods of data collection, illustrative findings from two different library systems, practical applications of individual user measurement, and areas where further research and development of the methods will be necessary. Also presented is the author's vita. (Author/ESR)

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New Approaches to the Measurement of Public Library Use by Individual Patrons

by

Philip M. Clark

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EDITOR'S NOTE

The text originally announced for this *Occasional Paper* will not appear in deference to a presentation of essentially the same material elsewhere. Our readers are strongly encouraged to examine this useful essay, "Public Library Services in Nigeria," by G.T. Onadiran and R.W. Onadiran in the *International Library Review* (volume 13, 1981, pp. 409-33); and see also "Public Library Development: An Assessment of Present Trends in Nigeria," by G.T. Onadiran and R.W. Onadiran in *Annals of Library Science and Documentation* (volume 28, nos. 1-4, March-Dec. 1981, pp. 119-23).

We regret the need for an adjustment in our announced intentions. We also feel specially compelled to concentrate our limited publishing program on texts that would not otherwise likely appear in print at all.

We will continue to consider condensations, expansions or reconceptions of another publication in print such as will usefully address the needs of an identifiable audience. As a case in point, the present *Occasional Paper*, which was originally scheduled to appear in 1984, is indeed based on a dissertation as noted. The present abridgement has been significantly reconceived, however, so as to address the particular needs of public librarians who are interested in a convenient overview of the techniques for measuring use by their patrons.

—*D.W. Krummel*

ABSTRACT

Based upon the concept that library use measurement should have as its basic starting point the individual patron, a method of data collection and analysis is presented that explores individual patterns of borrowing over time. The method accounts for the number of visits on which borrowing takes place, number of items borrowed per visit, total items borrowed over time and relates these to personal characteristics such as gender and distance of residence from the library.

Four "core groups" can be identified from the resulting analysis: core borrowers, heavy visitors, heavy borrowers, and light users. These are behaviorally different patrons and can be conceived of as different target groups for library services.

The concept of studying individual user patterns results in a variety of potential applications for library decision-making. Among those examined are: proportion of community residents who borrow; variation of use patterns by day of the week; use of multiple units of the same library system; a revised look at reciprocal borrowing policy; and new knowledge of patron characteristics in relation to library use. Future research can expand on the study to examine types of materials borrowed, exhaustion of the collection by the heaviest users and the development of new techniques to study other library service such as in-library use, question asking, and casual reading.

INTRODUCTION

This *Occasional Paper* is intended to be used as a type of model for public librarians who wish to study the patterns of use by individuals in their libraries. However, it is not written in typical "how-to-do-it" style for one important reason. That is, any approach to a new concept of looking at library use must explain and detail the rationale behind the new method; justify its purpose and intended application.

The fundamental concept of measuring the use patterns of individuals is introduced in part 1. This theme is the basis for the remaining parts that deal with the methods of data collection (part 2), illustrative findings from two different library systems (part 3), and practical applications (part 4), as well as areas where further research and development of the methods will be necessary (part 5).

The person seeking "how-to-do-it" information will gravitate to part 2. A warning is in order, however. The method results in a great deal of data on individual borrowing transactions that must be sorted, merged by patron identification number and ultimately compressed and categorized by what I term "core groups." Some sort of computerized data processing system is essential for these tasks. Further, I recommend that a pilot study be performed at a single location in order to work out these procedures. Later, other units can be incorporated into the study design to examine multiple-library use patterns.

The chapters on applications and future research only touch the surface of what may be examined through the study of individuals and their patterns of use. The Piscataway Public Library has already used the findings to justify the purchase of a new bookmobile, examine the impact on other library units of the opening of a new branch and to examine in detail the attitudes of their most frequent patrons toward services, collections and facilities. Thus, the method of study has practical implications and uses that may be copied or expanded upon by other public libraries.

I. THE CONCEPT OF THE INDIVIDUAL IN LIBRARY USE MEASUREMENT

The user of library services functions primarily as an individual rather than as a member of a group. Whereas group-related behavior in libraries is limited to such activities as class visits by school children, senior citizen attendance at lunchtime programs and adult attendance at film programs, by far the largest part of library use is personal and individualistic, spanning a multitude of interactions with library personnel, with the materials on the library shelves, or with the physical setting itself during solitary study or contemplation.[1]

Yet, in the measurement of library service output, individually oriented services (circulation of materials both inside and outside the library, reference and directional questions asked, facilities used or space consumed) are invariably reported as based, not on the number of individuals consuming such services, but on the total mass of such interactions with the library. Thus, total books circulated is a common measure; the number of individuals borrowing is not. With all other types of library service measures, too, the ultimate unit of analysis is not the individual user but either the gross service consumed or predefined groups that use the service. As Ennis and Fryden have pointed out:

> First, circulation records measure books, not borrowers. It is impossible without additional information to tell whether, say, an increase in circulation means more people are borrowing books at the same rate, or whether the same number of people are borrowing more books, or, what is irritatingly more likely, some mixture of both. For some policy questions it is important to know which of these things is happening.[2]

For many planning purposes it is important to know (1) the number of individuals borrowing from a particular library, and (2) the rate or amount of borrowing by each individual. This study postulates, then, that individual user behavior should be the primary unit of analysis for library planning and management. From this base it is a simple matter to transform library use into group use. However, when data on library use is collected initially by groups, one can only arrive at individual behavior by statistical inference, and such predictive power is sharply decreased when there is wide variability within each group.

The central problem of this study is to devise a reliable method for recording and analyzing individual use of libraries over time (a method that will examine what people do and not what they say they do[3]) and that will be applicable to broad areas of concern in both its theoretical and practical aspects. It must ask not only who uses libraries but also in what amount and to what purpose.[4]

In formal terms, the problem to be studied is that of (1) developing a methodology for determining the amount and frequency of library services use by individual patrons over time, (2) developing a methodology that can be used to analyze the relationships between behaviorally determined dependent variables such as amount of use and frequency of use with demographic variables that describe individuals, and (3) propose additions and enhancements to current models of planning and management that allow the findings to be put to use in a real-world setting. Although the method developed here has been used to study one facet of library service—the borrowing of material for use outside the library—the overall construct is applicable to any type of service offered by a library and used by library patrons.

The few previous studies of library use by individuals through the use of circulation records have been localized, restricted to the smaller college environment, and, with one known exception, have not attempted to study frequency of use (i.e., number of visits).[5] The only regularized program of data collection was one carried forth by Quigley at Montclair, New Jersey,[6] and in that case, staff comments suggest that the sheer volume of data handling soon led to a minimum of data analysis.[7]

The lack of circulation-record-based studies of individual library use has not meant a lack of research into individual users and uses of libraries. In hundreds of studies the face-to-face interview or the written questionnaire have asked the respondent to recall his or her past behavior.

There is cause to suggest however that self reports are inaccurate. Thus, nonusers in fact may report that they are users and persons reporting the number of times they have visited the library may either under- or over report their actual rate of visiting. In all cases, these "response errors" may reduce the accuracy of surveys and prompt over- or underestimates of library use. As Burns points out:

> One of the major difficulties with the two most commonly used instruments for conducting user studies is that both questionnaires and interviews depend on inferred data rather than on the collection of actual examples. The respondent "reports" his behavior, usually after the fact, or what he thinks or would like his behavior to be, with obvious implications and problems for the investigator.[8]

The only major validation of a library-related behavior is that reported in the Denver Validation Study[9] of 1949 (whose basis was whether one had a valid library card) elicited an inaccuracy rate of 13%.[10] One must conclude that even higher inaccuracy rates would be the norm for questions asking for detailed factual data such as "How many times have you borrowed books from the library in the past six months?" or "How many times have you visited the library for any purpose during the past year?"

It is a point of this study that the individual library borrower can be determined from existing records including facets of frequency of use, amount of use and personal characteristics. Based on this identification, further research can be conducted utilizing the techniques that are most appropriate to questionnaires and interviews—i.e., the study of attitudes and preferences. Existing statistical data can provide the solid base needed for identification and description of individuals while survey approaches can explore the attitudinal issues so important to the development of the field.

II. THE BASIC APPROACH TO MEASUREMENT

The Design of the Study

A major consideration in this study is that the design must be based, insofar as possible, on verifiable data collected as a part of the normal operating procedures of the library. This has two purposes. First, it allows the local

library to collect these data at relatively low cost; low cost in that additional staff for data collection are not needed. Second, it eliminates the problem of assessing the validity of self-reports.

Given the range of activities that an individual can engage in while present in the library, the activity that is more amenable to quantification is the borrowing of material for use outside the library. Other services are not as tightly controlled and thus the identification of the individual user is more difficult.

Most libraries issue "borrower's cards" to their patrons and assign a unique number to such cards. (Efforts are made to assure that an individual is assigned only one such card, but it must be recognized that efforts are not as intense to assure that the individual using a card is the person named on the card.)

The existence of these unique numbers affords the researcher the opportunity to trace individual borrowing of library materials. The number can be recorded each time it is used over a period of time and summarized for that period of time as to its total uses.

In cases where no unique patron number is assigned, an algorithm based on the person's name and address could be substituted for the unique number. However, the processs of data collection and analysis developed in this study would remain the same whether the patron is identified by a unique number or by an algorithm.[11]

The methods of data collection includes the following specific procedures. First, if the system of circulation control in the subject library is maintained through the use of an impact printer such as that distributed by the Gaylord Company, the number will be impact printed on a separate data collection form. Each library unit will maintain its own collection forms so that libraries within a system may be compared. Additional data will be entered on the number of items circulated by that individual.

Second, the total number of items charged out to a patron will be recorded next to the individual library card number. Since this study does not examine the type of material borrowed by individual patrons, only the number of items charged out to a patron will be recorded. As there is some continuing debate in the field as to what items ought to be counted toward a library's circulation total, this study accepts the definitions in use in the subject library. If at some later date the mehodology were to be employed to compare different library systems, a standardization of definition of what constitutes a "circulation unit" would have to be determined.

Third, the data recorded must reflect frequency of use. It is felt that the concept of frequency of use adds an important dimension to the study of library use especially when examined in conjunction with a measure of amount of use. A heavy borrower, that is a person who borrows many more items than is "normal," may be either a heavy visitor or a light visitor. In effect, even individuals who are well above average in their total borrowing may make few visits to the library. Conversely, they may make many visits but borrow few items on each visit. It is felt that there is a significantly different behavioral pattern based on the number of visits made to a library by an individual.

For the purpose of this study, a "visit" is the combined incidences of borrowing on a given day at a given location, since many individuals do not necessarily charge out all items borrowed at the same time on a given day. (For example, a parent may enter the library with a child who is attending a story hour, select some material and charge it out, but upon the conclusion of the story hour be prompted to borrow additional material.) Though, for the purposes of this study, the total of all transactions taking place on a single day will constitute one visit, such a definition might not be appropriate for academic, special, or research libraries. In such settings, individuals may indeed make multiple trips to the library on a single day and borrow material on each visit. In such cases, a "time of day" measure might be incorporated into the design with the qualification and understanding mentioned above.

Note that the concept of a visit is imbedded in the idea that a visit means a use of a specific location or facility. It is quite possible that an individual may visit a number of different library locations all in the same day. The design must allow such behavior to be revealed.

All individual library card numbers will be entered on a log with the total items borrowed on each occasion entered next to the card number. The logs will be dated and a separate log maintained for each library unit in the study. A computer merging routine will be used to combine all occasions of borrowing within a given day into a summary total for that day for that individual. This will count as one visit.

This study will continue data collection at a given site for a period of time that permits the analysis of repeat use by individuals. Theoretically, repeat use can be measured over a multi-year time span. However, practically speaking the time span was limited in this study by financial considerations. Thus, a minimum of two months of continuous data collection was established.

The resulting total data record that is available for analysis contains the following information:

1. identification of the loaning library;
2. day, month and year of the visit;
3. identification of the issuing library of the individual's library card (this is needed to ascertain nonresident borrowers);
4. identification number of the individual borrower; and
5. total number of items borrowed by the individual on this date.

Data available for analysis of personal characteristics of borrowers varies enormously from library to library. However, for the purposes of designing a general methodology, this study will assume that only the bare facts of name and address are present on the registration card. If other personal characteristics are available, they can be entered into the data file following the same procedures here outlined.

Assuming that the gender of the individual is not listed on the registration card, an informed guess may be made from the first name of the patron. The greatest chance of error is encountered in the following circumstances: (1) when only initials are given, (2) when the individual is of foreign extraction, or (3) when the first name is common to both genders. If only initials are given, the gender cannot be assumed and a "not determined" code assigned to the individual. Names of individuals of foreign extraction can be checked with knowledgeable individuals of that extraction. Names common to both genders must be coded "not determined."

From the address of the individual, the location of the residence can be coded within the community. A relatively simple procedure for doing this would be to section off a map of the community in grid-like fashion. Streets could be given horizontal and vertical coordinates and these coordinates coded into the individual patrons' data record. Where streets cross a number of different grid sections, the street number of those intersections must be determined.

Once the address has been coded as to its grid coordinates, the relative distance of that grid section from the section containing the library facility can be determined. Assuming all grid sections to be of equal size (and they must be), a relative distance scale can be constructed. An example of this is shown in figures 1 and 2.

GRID	A	B	C	D	E	F	G	H	I	J	K
01						0 0.0	15 0.5	26 0.8	0 0.0		
02						0 0.0	68 2.2	54 1.7	0 0.0		
03					75 2.4	90 2.9	61 2.0	14 0.4	0 0.0		
04			0 0.0	18 0.6	49 1.6	72 2.3	83 2.7	84 2.7	0 0.0		
05		0 0.0	55 1.8	17 0.5	31 1.0	96 3.1	48 1.5	72 2.3	1 0.0		
06	0 0.0	0 0.0	32 1.0	4 0.1	0 0.0	3 0.1	34 1.1	27 0.9	0 0.0		
07	64 2.1	49 1.6	42 1.3	44 1.4	0 0.0	5 0.2	17 0.5	13 0.4	3 0.1	31 1.0	
08	0 0.0	2 0.1	284 9.1	128 4.1	42 1.3	27 0.9	17 0.5	73 2.3	65 2.1	79 2.5	18 0.6
09		0 0.0	103 3.3	126 4.0	70 2.2	24 0.8	50 1.6	0 0.0	26 0.8	27 0.9	0 0.0
10			1 0.0	233 7.5	2 0.1	16 0.5	118 3.8	42 1.3	2 0.1	0 0.0	0 0.0
11			0 0.0	5 0.2	66 2.1	0 0.0	23 0.7	20 0.6	0 0.0		
12						0 0.0	13 0.4	13 0.4	0 0.0		

Fig. 1. Graphic Representation of Case 1 Showing Number of Individuals and Percent of Individuals Residing in Grid Sections

Analyzing Relationships Between Variables

Having defined the methods and procedures for measuring the variables in the study, the next task is to develop the methodology for analyzing the relationships between these variables. In the most general sense, the set of relationships between the use variables and the personal variables are set forth in table 1.

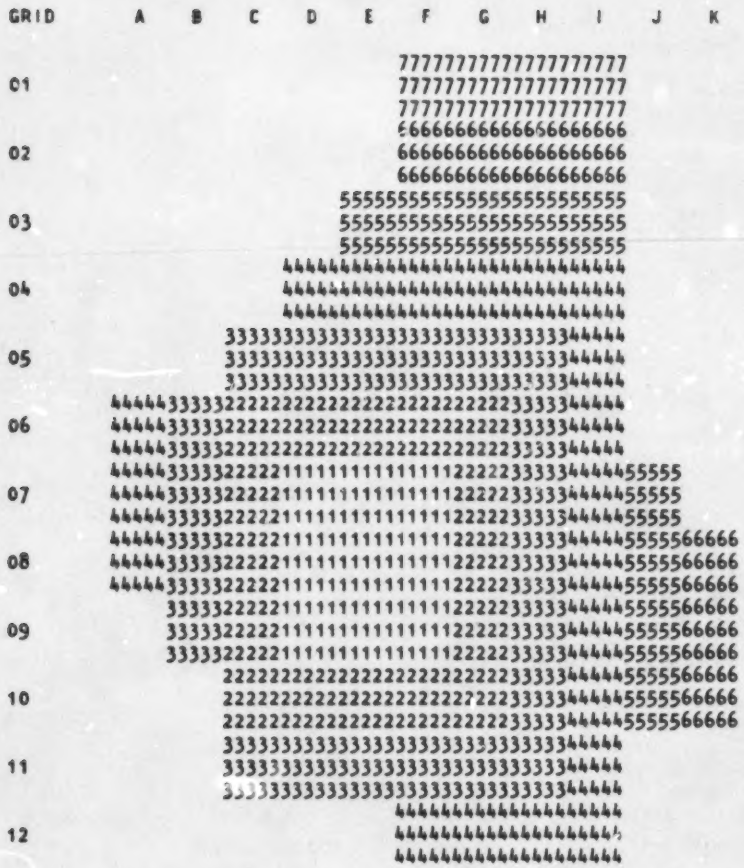

Fig. 2. Graphic Representation of Case 1 Detailing Concentric Rings of Distance from the Main Library

Each of the independent variables will be used to analyze each of the dependent variables. Thus, both visits and circulations will be analyzed by gender and location of residence. In addition, a composite dependent variable can be constructed from the combined scores of an individual on both visits and circulations.

The first task is to study the relationship between the two dependent variables. If we assume that each of the dependent variables has a min-

TABLE 1
RELATIONSHIPS BETWEEN VARIABLES

		Independent Variables	
		Gender	Location of residence
Dependent Variables	Visits		
	Circulations		

imum of two values and we name these two values "high" and "low," the most elementary cross-tabulation or study of relationships would yield a 2 x 2 matrix. Table 2 illustrates this matrix.

TABLE 2
THE BASIC MODEL

		Visits	
		High	Low
Circulations	High	A	B
	Low	C	D

Assuming for the moment that we have operationally defined the division point between "high" and "low," we can see that individuals in "cell" A are high on both visits and circulation, individuals in "cell" B are low on visits but high on circulations, individuals in "cell" C are high on visits but low on circulations, and individuals in "cell" D are low on both visits and circulations.

—*Core Borrowers* (cell A). Those individuals who borrow heavily and visit frequently can be called "core borrowers." As a group it scores highest on both number of visits and number of circulations.

—*Heavy Borrowers* (cell B). A group of individuals identified as those who borrow more heavily than other groups but visit less frequently.

—*Heavy Visitors* (cell C). An individual who visits frequently but borrows relatively little.

—*Light Users* (cell D). Those who visit infrequently and borrow few materials.

Now the specific problem is to define the dividing point between "high" and "low" for both number of circulations and number of visits. Although it is possible to arbitrarily decide that, for example, the individuals who make up the top 25% of those who circulate material and the individuals who make up the top 25% of those who visit will be ranked as "high" and those individuals in the bottom 75% will be ranked "low," it is better to use a measure that is unbiased and not dependent upon the whim of the investigator. The actual frequency distribution of the library under study should exert some influence on where to locate the dividing points between the cells.

One might choose to take the median or the mean as the dividing point, but if we wish to assure that "high" will really be high, the use of the standard deviation in conjunction with the mean appears to be most appropriate.

A population that is normally distributed has 68.26% of the cases within plus or minus one standard deviation of the mean. Thus 32% of the cases will be in the extreme end of the distribution with 15.87% more than one standard deviation *above* the mean and 15.87% more than one standard deviation *below* the mean. If the distribution is skewed (as we would expect from the findings of Berelson[12] concerning concentration of use), an even lower percentage would be in the upper end of the distribution.

Using the criteria that the dividing point between "high" and "low" will be established at the point of one standard deviation above the mean, there is definite assurance that the highest volume borrowers and highest frequency users will be classified in the "high" category. Practical considerations will affect the decision as to which criterion to employ. If the purpose of a study is to identify a group of library borrowers who are known to have high rates of visiting and borrowing, *and* to minimize the absolute number of such borrowers, one would use the method of the mean plus one standard deviation, because here the ratio between the percent of individuals in the Core Borrower group and the percentage of both circulations and visits accounted for is highest. Such a study might be conducted in order to identify a group of individuals who would be personally interviewed about their choices of reading material. Thus, interview costs could be kept low which assure that the individuals chosen would have high rates of library borrowing upon which to base judgments about reading preferences. But, it should be noted that such a group would not represent all library borrowers but only the most frequent and highest volume borrowers.

In the same vein, if interviewing costs are not a consideration but high frequency and volume of use were important, one could choose to use the median or the mean to locate the core borrower group.

It is then possible to analyze the characteristics of all the heaviest borrowers and the most frequent visitors, which represent but a small proportion of the population. For the much larger group of light users certain sampling techniques can be used, as will be demonstrated.

Application of the Method

The data to be used in the testing of the basic model of an individual's amount of and frequency of library use was collected in two different library systems located in New Jersey. At the Piscataway Public Library serving Piscataway Township, New Jersey, data were first collected at the main library only from 25 September 1979 through 29 December 1979. This is henceforth referred to as case 1 (1979). Further data collection in Piscataway was conducted at the branch library, the bookmobile and at the main library from 15 October 1980 through 13 December 1980. This is referred to as case 2 (1980). Finally, at the Sussex County Library headquartered in Newton, New Jersey, data were collected at the main library and two branches from 17 December 1980 through 21 February 1981, and are referred to as case 3 (1981).

The Piscataway Public Library serves Piscataway Township, a suburban community, which had an estimated 1979 population of 39,544. Total 1979 income for the library system was $366,836 which supported two library buildings and a bookmobile, 7 certified professional librarians, 22 full-time equivalent staff members, and 5803 volumes added during that year. Total circulation for 1979 was 187,920 items from a total collection of 73,314 volumes.[13]

The Sussex County Library system serves directly all the municipalities of Sussex County with only one exception. The County Library is designated as an Area Reference Center by the New Jersey State Library and, in that sense, is indirectly responsible for service to the entire county. Sussex County, exurban to rural, had a 1980 population of 114,358 with a population density of 217.3 persons per square mile. The income for the library system in 1979 was $808,553 which supported a Main Library, five branch libraries and a bookmobile, 13 certified professional librarians, 33 full-time equivalent staff, and 11,411 volumes added for the year. The circulation for 1979 was 385,028 items from a total collection of 233,605 volumes.[14]

The data collection was continuous during each study period on every day a library location was open to the public. This meant a total of 77 days of collection in case 1, 49 days in case 2 (except on the bookmobile which was open 31 days), and 52 days in case 3.

At each location a manual Gaylord charge machine impact printed the borrower's number on a special form or log of the daily circulation transactions, and the circulation staff member recorded the total number of items borrowed by each patron next to the borrower's number. A new log card was used for each day for each library location. In case 1 the data contained on logs were transferred to a computer file by the use of punched cards. In cases 2 and 3 a remote computer terminal was used to transfer the data. Nearly 30,000 entries were made for transactions included in this study.

In accordance with the definition of *visit* as used in this study, multiple incidences of transactions by the same borrower on a given day were merged into one record indicating the location, date, issuing library, patron identification number, and total items circulated.

Upon completion of the merging routine, the raw data were available for analysis. Except for certain manual tabulations, all analysis was performed using the facilities of SPSS Version H, Release 8.0 for the IBM Model 370 computer.

III. ILLUSTRATIVE FINDINGS

Description of the Population

The population of the study is composed of all visits made by individuals over the course of the data gathering in the library location studied. Tables 3 and 4 summarize some of the information gathered.

At a glance, one familiar point is challenged in table 4. That is, that the number of items checked out per person per visit is about three in number.[15] There is a substantial difference between the libraries in case 2 and case 3. The case 2 libraries group around the three items per visit figure but the case 3 libraries group around the four items per visit figure. This is a 25% difference in the number of items checked out per visit.

Two measures of central tendency were calculated for each frequency distribution, the median and the arithmetic mean, as well as a measure of dispersion (the standard deviation). Table 5 displays the results of this series of calculations.

TABLE 3

SUMMARY DESCRIPTION OF INDIVIDUALS, VISITS, CIRCULATIONS FOR THREE CASE LIBRARIES

Case	*Number of Individuals*	*Number of Visits*	*Number of Circulations*
Case 1			
Main library	3,144	6,769	23,477
Case 2			
Main library	2,764	5,547	17,878
Branch	1,348	2,766	8,557
Bookmobile	493	812	2,510
Total cases	4,075	9,125	28,945
Case 3			
Main library	2,669	5,288	23,845
Branch A	869	2,118	8,738
Branch B	726	1,786	6,985
Total cases	4,673	9,192	39,568

TABLE 4

AGGREGATE COMPARATIVE STATISTICS

Case	*Mean Circulations Per Individual*	*Mean Visits Per Individual*	*Mean Circulations Per Visit*
Case 1			
Main library	7.5	2.2	3.5
Case 2			
Main library	6.5	2.0	3.2
Branch	6.3	2.1	3.1
Bookmobile	5.1	1.6	3.1
Case 3			
Main library	8.9	2.0	4.5
Branch A	10.1	2.4	4.1
Branch B	9.6	2.5	3.9

Using case 2 - Branch as an example, table 5 indicates that 2766 visits (see column heading *N*) were made to the branch library during the study period. Individuals made a minimum of 1 visit and a maximum of 27 visits. Half of the individuals (the median) visited less than 1.447 times and half more than this amount. The arithmetic mean or average number of visits was 2.052 with a standard deviation of 1.805. If the distribution were normally distributed (and it is not) 15.87% of the individuals would be in the upper end of the distribution. That is, they would have scores greater

TABLE 5

COMPUTED MEDIAN, MEAN, STANDARD DEVIATION, RANGE AND SUM FOR THREE CASE LIBRARIES

Case	*Median*	*Mean*	*Standard Deviation*	*Range*	*N*
Case 1					
Main library					
Visits	1.450	2.153	1.877	1-16	6,769
Circulations	4.177	7.467	10.326	1-164	23,477
Case 2					
Main library					
Visits	1.424	2.007	1.614	1-14	5,547
Circulations	3.763	6.468	9.074	1-217	17,878
Branch					
Visits	1.447	2.052	1.805	1-27	2,766
Circulations	3.711	6.348	8.868	1-141	8,557
Bookmobile					
Visits	1.330	1.647	0.992	1-5	812
Circulations	3.285	5.091	6.967	1-117	2,510
Total cases					
Visits	1.560	2.239	1.974	1-27	9,125
Circulations	4.060	7.103	10.108	1-127	28,945
Case 3					
Main library					
Visits	1.396	1.981	1.820	1-49	5,288
Circulations	5.127	8.934	13.574	1-402	23,845
Branch A					
Visits	1.520	2.437	2.580	1-46	2,118
Circulations	4.904	10.055	20.297	1-436	8,738
Branch B					
Visits	1.665	2.460	2.478	1-27	1,786
Circulations	5.561	9.621	12.908	1-146	6,985
Total cases					
Visits	1.488	2.257	2.798	1-132	9,192
Circulations	5.303	9.715	19.332	1-930	39,568

than the sum of the mean and one standard deviation or, in this example, 2.052 plus 1.805 equaling 3.857.

An example of the extent to which a small percentage of the population, falling into the three "high" categories, accounts for a large proportion of the visits and circulations is shown in table 6.

Similar calculations for all the locations show that the three "heavy" cells contain from 9% to 13% of all individuals, but account for about one-third of all visits and for one-quarter to a half of all items circulated.[16]

TABLE 6
CELL PARAMETERS USING MEAN PLUS STANDARD DEVIATION FOR CASE 1 LIBRARY

	Percentage of Individuals	*Percentage of Visits*	*Percentage of Circulations*
Light users	88.2	66.6	56.0
Heavy visitors	3.3	8.8	5.8
Heavy borrowers	2.8	4.6	9.8
Core borrowers	5.8	20.0	28.4
Number	(3,144)	(6,769)	(23,477)

Data for Analysis in Case 1 (1979)

It was not necessary to search the registration file for all 3144 individuals who were indentified as having borrowed during the period of the study. All of the much smaller number of individuals who made up the heavy visitor, heavy borrower, and core borrower groups could be selected for data collecting regarding personal characteristics. For the larger light user group, a method of sampling was invoked to obtain a much smaller list for further study.

Based on preliminary estimates of the mean and the standard deviation, all individuals having four or more visits and all individuals having 15 or more circulations were selected for this phase of the study. These criteria yielded a total of 570 individuals or 18.3% of the total population. The remaining 2574 individuals constituted the lightest users. Of this group a sample target of 200 cases was determined to be adequate for the intended analysis. The method of sample selection was sequential with a sample interval of 13 being adequate to achieve the target of 200 sample cases. A random start was made in the first interval and the final sample size was 198.

The 198 cases that constitute the sample of lightest users were then weighted in the analysis to reflect their proportionate size in the population.

As a result of these procedures, 768 cases were selected for further analysis. A search of the registration file of the library was made with the result that the following information was available for each of the following variables:

1. library issuing borrower card;
2. patron identification number;

3. total number of visits;
4. total number of circulations;
5. gender (of the 768 cases, 22 [2.9%] had to be designated as "not known");
6. adult/juvenile status;
7. location of residence;
8. geographical section of residence;
9. employment address if non-resident; and
10. core group designation.

Items five through nine were coded directly from the registration file but the adult/juvenile status variable was judged not sufficiently accurate to use in this study.

Using a keyed street map of the community we were able to code each house number according to the grid section in which it lay. If an individual was employed in the community but lived in another community, the employment address was coded. These individuals were, however, coded as non-residents. Individuals who neither lived in the community nor were employed in the community were excluded from this analysis. In that the registration cards for these individuals were located in their home library, personal information was not available. Seven cases where a post office box number was the only address were coded as "not available."

An approximation of linear distance of the residence (or place of employment) from the main library was achieved by assigning codes from one through seven to all grid sections, establishing in effect, a series of seven radiating rings starting with the grid section containing the main library (see fig. 1).

Data Collection Procedures for Case 3 (1981)

A similar procedure was taken in case 3 for the collection of personal characteristics data. First, based on the mean and the standard deviation for the entire population, all individuals with five or more visits and all individuals with 25 or more circulations were included in this phase of the study. These two criteria yielded 265 individuals who used the main library, 132 who used branch A and 104 who used branch B for a total of 501 individuals. Second, a sample of the remaining individuals for each library location was taken using the sampling procedures of SPSS. Of the lightest users of the main library, 133 were selected as were 100 from branch A and 102 from branch B. The total from all three locations was thus 335.

Therefore, 836 individuals constituted the base upon which further analysis was made through data obtained on the registration card.

The resulting categories of information that were available included:

1. age level (the library files contain a designation of adult or juvenile that is compiled by the staff. This designation was accepted);
2. gender (coded entirely by first name. A few cards were issued to married couples and were so coded); and
3. town of residence and postal route designation where applicable.

In addition, each individual was coded as to his/her primary library used and whether or not he/she used more than one library in the system.

While the following analyses are based primarily on population data for the heaviest users and sample data for the lightet users, it must be noted that the findings only apply to the case libraries in the defined time periods of the study. Although one cannot generalize these findings to other libraries in other locations, the method of data collection and analysis is applicable to other libraries in other locations. Applied to a properly constituted random sample of libraries, this method would yield generalizable results.

Circulations Per Visit

Statistical analysis reveals a significant relationship between the number of visits and the number of circulations. Such a relationship would not occur by chance in 1 out of 100,000 times. This observation leads us to the calculation of a new variable termed "circulations per visit." By dividing the number of visits by an individual into the total number of circulations accounted for by an individual we arrive at a "standardized" score. This procedure corrects for the absolute differences in visits and circulations due to differing lengths of time that library service is available to the patron. Such standardization is especially important when we wish to make comparisons between different library units in a library system or to make comparisons between different library systems.

There is little literature on the number of items circulated per visit. Questions arise as to the differences that exist between different types of units within a system, between systems in different communities, and between different types of patrons such as men and women, individuals living close to the library *v.* those living at a distance and so forth. Table 7 illustrates the differences between the library units included in this study.

One can see from this table that there is a high degree of internal consistency within each system but that the two systems in the study differ with regard to the number of items circulated per visit. The system comprising

TABLE 7

MEAN, STANDARD DEVIATION AND VARIANCE OF ITEMS CIRCULATED PER VISIT BY LIBRARY UNIT

Case	*Mean*	*Standard Deviation*	*Variance*
Case 1			
Main library	3.1321	2.1490	4.6183
Case 2			
Main library	3.0083	2.4494	5.9994
Branch	2.8633	2.0673	4.2739
Bookmobile	2.8969	2.3622	5.5798
Total	2.9539	2.3349	5.4516
Case 3			
Main library	4.0696	3.1478	9.9086
Branch A	3.8867	3.2283	10.4219
Branch B	3.6757	2.9083	8.4584
Total	3.9655	3.1281	9.7848

case 3 averages approximately one book per visit more than the system in case 1 and case 2. Cases 1 and 2 are very similar even though the data were collected one year apart.

It is important to note that the dispersion (standard deviation) and variance are different between the two library systems. In effect, the library system reflected in cases 1 and 2 includes patrons who adhere more tightly to the mean of circulations per visit than do the patrons included in the case 3 system.

The conclusion reached is that the variable "circulations per visit" is useful as a descriptive and comparative measure. In particular it allows comparisons to be made over unequal time periods of data collection, and between different library units and library systems.

Relationship of Gender to Library Use

Descriptively, the methods used in this study show that borrowers are composed primarily of women (see table 8). Women were 60% of all borrowers in case 2 and 68% in case 3.

However, in both library systems, women accounted for only a slightly greater amount of the total visits and circulations than did their proportion in the population (see tables 9 and 10).

TABLE 8

PROPORTION OF MEN AND WOMEN IN THE STUDY POPULATION

	Case 1	*Case 3*
Men	39.7%	32.1%
Women	60.3%	67.9%
Number	3,058	4,224

TABLE 9

PERCENT OF VISITS AND CIRCULATIONS ACCOUNTED FOR BY MEN AND WOMEN— CASE 1

	Visits	*Circulations*
Men	37.0%	33.3%
Women	63.0%	66.7%
Number	6,547	22,584

TABLE 10

PERCENT OF VISITS AND CIRCULATIONS ACCOUNTED FOR BY MEN AND WOMEN—CASE 3

	Visits	*Circulations*
Men	27.8%	24.8%
Women	71.7%	75.0%
Number	8,987	37,737

If we compare the average number of circulations per visit, (table 11) we find that men borrow slightly less than women per visit on the average in each case.

Both men and women in case 3 average more circulations per visit than do men and women in case 1. The standard deviations and variances are also much greater in case 3, thus indicating greater dispersion from the mean than in case 1.

What is the influence of gender on the makeup of the four core groups described earlier? Tables 12 and 13 describe the percentage distribution of men and women across these four groups.

TABLE 11
Mean, Standard Deviation and Variance of Circulations per Visit for Men and Women

Case	*Mean*	*Standard Deviation*	*Variance*	*N*
Case 1				
Men	2.9034	1.9406	3.7660	1213
Women	3.2833	2.2710	5.1574	1845
Total Population	3.1321	2.1490	4.6183	3058
Case 3				
Men	3.5175	2.8346	8.0351	1358
Women	4.1778	3.2368	10.4766	2866
Total Population	3.9656	3.1281	9.7848	4224

TABLE 12
Percentage Distribution by Gender of Core Groups--Case 1

	Men	*Women*	*N*
Light users	40.7	59.3	2698
Heavy visitors	39.6	60.4	101
Heavy borrowers	18.6	81.4	86
Core borrowers	34.7	65.3	173
Total percentage	39.7	60.3	
Total *N*	1213	1845	3058

TABLE 13
Percentage Distribution by Gender of Core Groups—Case 3

	Men	*Women*	*N*
Light users	33.0	67.0	3862
Heavy visitors	38.3	61.7	107
Heavy borrowers	13.6	86.4	111
Core borrowers	19.4	80.6	144
Total percentage	32.1	67.9	
Total *N*	1358	2866	4224

Here we see that women account for a disproportionate share of the heavy borrowers in both cases. In case 3 they also account for a disproportionate percentage of the core borrowers. This is in line with the previous finding that women borrow more per visit than do men (see table 11).

But in general this study tends to confirm previous research findings suggesting that gender explains little of the variability of library use. Women as represented in the population do not account for a much greater proportion of the visits and circulation of the case libraries. That they borrow approximately 0.5 items per visit more than men do on the average does not appear to be a dramatic difference. If the guess that women are more likely to be borrowing for other family members than are men is borne out in further research, the differences between the circulations per visit of men and women would narrow to the point of equality.

The findings that women are represented disproportionately in the heavy borrower group may also reflect more family borrowing by women, and the greater variance in circulations per visit suggests that certain women (especially, perhaps, those with children) borrow more heavily on a per visit basis than do men.

Finally, the analysis of data by gender suggests that the methodology used in this study allows a new degree of precision in the description of this commonly used category of demographic information.

Relationship of Residence Location to Library Use

The distance an individual travels to use the library has been a relatively common topic of discussion in user studies. The general finding has been that use decreases as distance increases. The studies have, however, been based either on self-reports of use by analysis of registration files, rather than by recorded borrowing use.

This study investigated this concept with data that are not subject to self-reporting errors by respondents. The study recorded actual incidences of borrowing and then used the registration file to establish the location of the residence in relationship to the library.

In case 1 all borrowers were located on a grid map (using addresses on file) as shown in figure 1. In this instance, a grid section is just slightly under one-half mile on each side. Figure 2 shows the construction of a linear distance scale of grids from the main library and table 14 shows the distribution of addresses on this scale.

TABLE 14

FREQUENCY AND PERCENTAGE DISTRIBUTION OF DISTANCE OF RESIDENCE FROM MAIN LIBRARY—CASE 1

	Frequency	*Percentage*
Distance 1	446	15.0
Distance 2	954	30.6
Distance 3	641	20.6
Distance 4	493	15.8
Distance 5	378	12.1
Distance 6	140	4.5
Distance 7	41	1.3
Total	3,113	100.0

Table 15 presents the percentage of visits and circulations accounted for by each distance ring. In addition, the table presents the mean number of circulations per visit by distance from the library.

TABLE 15

PERCENT OF VISITS AND CIRCULATION ACCOUNTED FOR AND MEAN CIRCULATIONS/VISIT BY DISTANCE FROM THE MAIN LIBRARY

	Percentage of Visits	*Percentage of Circulations*	*Mean Circulations/Visits*
Distance 1	15.8	15.0	2.95
Distance 2	32.4	32.1	3.13
Distance 3	21.3	21.4	3.36
Distance 4	15.4	16.5	3.27
Distance 5	10.2	10.2	2.76
Distance 6	4.1	4.3	3.55
Distance 7	0.8	0.5	2.31

The individuals living in each distance ring account for the same proportion of visits and circulations as their proportion in the population. That is, the percentages in table 14 are mirrored by the percentages in table 15. This indicates that there is little difference by distance in the relative proportion of visits and circulations accounted for.

In terms of the mean number of circulations per visit, there is also little difference between the distance rings. At the least the average number of

circulations per visit would not appear to increase steadily as the distance from the library increases—nor does it decrease.

Finally, table 16 compares the percentage distribution of individuals in each core group by their distance from the main library.

TABLE 16
PERCENTAGE DISTRIBUTION OF CORE GROUPS
BY DISTANCE FROM THE MAIN LIBRARY

	Light Users	*Heavy Visitors*	*Heavy Borrowers*	*Core Borrowers*	*Total*
Distance 1	14.8	20.0	15.9	14.9	15.0
Distance 2	30.2	31.0	31.8	37.0	30.6
Distance 3	20.9	21.0	10.2	21.0	20.6
Distance 4	15.7	12.0	22.7	16.0	15.8
Distance 5	12.4	12.0	11.4	8.8	12.1
Distance 6	4.6	2.0	8.0	2.2	4.5
Distance 7	1.4	2.0	0.0	0.0	1.3

Although the heavy borrower group has a higher percentage in distance ring 4 than would be predicted and a lower percentage in distance ring 3, and although the core borrowers are more numerous in distance ring 2 than would be expected, the overall distribution by core groups by distance from the library matches fairly well the overall proportion in the population.

Based on the evidence from this part of the study then, one would conclude that distance is not related to the number of visits or circulations, nor to the average number of circulations per visit. And, in that the core groups are a reflection of the number of visits and circulations per individual, distance is also not related to this composite variable.

The more rural system studied in case 3 presents a more complex problem in analyzing distance. Here addresses are postal route numbers rather than specific street addresses. An effort was made to have the post office supply information on the box numbers that were farthest from the point of origin so that a general linear scale could be determined. This information was not made available and thus a distance scale for postal routes was not possible.

In lieu of a precisely determined distance scale, a judgmental sample of postal routes and/or towns was selected to represent individuals living close to the particular library unit and individuals living at a "considerable" distance from the library unit. For the two branches a comparision was made between the borough residents (i.e., those living in the immediate confines of the municipality in which the library is located) and residents of municipalities outside the borough.

Table 17 summarizes the average number of visits, circulations and circulations per visit for the "close residents" and the "far residents" of the main library. On the average, "close residents" borrowed fewer materials, visited slightly more times, and averaged considerably fewer circulations per visit than did the "far residents."

TABLE 17

COMPARISON OF AVERAGE NUMBER OF VISITS, CIRCULATIONS, AND CIRCULATIONS PER VISIT BY DISTANCE FROM THE MAIN LIBRARY

	Close Residents	*Far Residents*
Mean visits	2.16	1.98
Mean circulations	9.0	9.45
Mean circulations/visits	3.79	4.92
N towns/RFD routes	(5)	(6)

Branch A shows a similar pattern to the main library (see table 18). But in branch B, borough residents visited more often, borrowed more items and averaged more circulations per visit that did nonresidents (see table 19).

TABLE 18

COMPARISON OF AVERAGE NUMBER OF VISITS, CIRCULATIONS, AND CIRCULATIONS PER VISIT BY RESIDENTS AND NONRESIDENTS OF BRANCH A MUNICIPALITY

	Borough Residents	*Nonborough Residents*
Mean visits	2.7	2.3
Mean circulations	9.9	10.6
Mean circulations/visits	3.4	4.5
N towns/RFD routes	(1)	(12)

TABLE 19

COMPARISON OF AVERAGE NUMBER OF VISITS, CIRCULATIONS, AND CIRCULATIONS PER VISIT BY RESIDENTS AND NONRESIDENTS OF BRANCH B MUNICIPALITY

	Borough Residents	*Nonborough Residents*
Mean visits	2.5	2.3
Mean circulations	10.7	8.5
Mean circulations/visits	3.7	3.3
N towns/RFD routes	(1)	(6)

The question of the relationship between distance of residence from the library and core group status yielded different answers for the different locations in case 3[19] (see tables 20, 21 and 22). Whereas at the main library all core groups are likely to be "close residents," at the branches all core groups are about equally divided between borough residents and nonborough residents. The only major exception is found among the heavy visitors of the branch A library where 68% of them have their residential address in the borough. It is felt that the method of coding the branch users by borough/nonborough status lacks sufficient detail to truly differentiate between core group members. This question should be pursued through further research where a more detailed distance scale could be constructed.

TABLE 20

COMPARISON OF CORE GROUP MEMBERSHIP WITH DISTANCE—MAIN LIBRARY

	Close	*Far*	*N*
Light users	66.2	33.6	1216
Heavy visitors	93.3	6.7	30
Heavy borrowers	71.4	28.6	28
Core borrowers	83.9	16.1	31
N	(881)	(424)	(1305)

Summary of Findings

An exploration of the correlation between the number of visits and the number of circulations led to the construction of a composite variable termed "circulations per visit." This variable is useful when comparisons

TABLE 21
COMPARISON OF CORE GROUP MEMBERSHIP WITH DISTANCE—BRANCH A

	Borough Residents	*Nonborough Residents*	*N*
Light users	47.8	52.2	688
Heavy visitors	68.0	32.0	25
Heavy borrowers	43.3	56.7	30
Core borrowers	46.0	54.0	50
N	(382)	(411)	(793)

TABLE 22
COMPARISON OF CORE GROUP MEMBERSHIP WITH DISTANCE—BRANCH B

	Borough Residents	*Nonborough Residents*	*N*
Light users	44.7	55.3	595
Heavy visitors	44.8	55.2	29
Heavy borrowers	50.0	50.0	12
Core borrowers	50.0	50.0	30
N	(300)	(366)	(666)

are to be made between units of the same system or between systems. It was determined to be a useful descriptive and comparative measure.

The gender of the borrower was found to have little explanatory power. While there were significant correlations, the strength of the relationship was quite low. Women were found to outnumber the men by a sizable margin as expected, but they did not account for a greater proportion of either visits or circulations than would be expected from their proportion in the population. Women do, however, account for a higher proportion of the heavy borrower group than would be expected and in case 3 they also accounted for a higher proportion of the core borrowers than would be expected.

In the two cases analyzed, with the use of crude distance scores, no clear-cut relationship was found between distance from the library and patterns of individual use.

Due to the ability to efficiently use sampling to lower the number of light users that need to be included in any analysis, the methods and procedures developed to study the relationship between behavioral variables and personal variables has great promise. Some extensions and applications of this method will now be explored.

IV. APPLICATIONS OF THE MODEL

Number of Borrowers and Frequency of Use

The focus of this study has been on the individual user and the individual's frequency and amount of use of library borrowing services over time. We have shown that such data can be collected and can bring a new perspective to the study of patterns of library use. With such data a library can measure its output in a new and different way. The output measure that is in common use—total circulation—can now be supplemented with measures of total visits and total individuals served.

The concept of individual use can also be extended to areas of service other than the borrowing services. It is possible to begin to conceptualize the totality of individuals served whether or not they borrow material. Administrators and researchers can begin to think about people who ask questions and those who do not, about people who attend library programs and those who do not, and about people who use the collections and facilities but are never recorded through the usual reporting procedures. And, we can do so in terms of the passage of time thus bringing into our thinking the concept of repeat use.

That individual patterns of borrowing and visiting have not been explored previously in any depth may have been due to data analysis limitations. Circulation system automation has taken a quantum leap forward in only the past five years in most libraries. The sheer mass of data that can be collected in even a study as restricted as the present one ultimately means that the data must be analyzed by computer for efficient and economical use of the findings. That limitation has now been breeched with the availability of more efficient computers. The present study has shown that the data can be collected rather easily using noncomputerized means. In addition, the analysis is capable of being performed on relatively inexpensive microcomputers.

In addition to the output measure "circulation," two new measures of output have been shown to be available through the application of the methodology. The first of these is the measure of "visits" which relates to

frequency of use. The second is a measure of the number of individuals who make use of the borrowing services of a library.

Past studies of "visits" have relied largely upon self-reporting; a method subject to inaccuracies of recall. The current methodology provides a much firmer base upon which to establish the frequency of borrowing services use. Data are collected continuously and are not easily manipulated by the persons collecting the data. In this sense, they have a high degree of reliability. (One possible source of error comes with the use of the same borrower's card by different individuals. Later in this section, a proposal is made regarding the use of a panel study of users for the purpose of verifying matters of this sort.)

The inclusion of the frequency of user measure (i.e., visits) allows the construction of various ratios. The ratio explored extensively in this study has been the circulation per visit. In an expanded study the concept of the visit can be used to measure other types of library use including such matters as number of questions asked per visit, number of facilities and/or equipment used, time spent in the library per visit, and the like.

Use of "number of individuals served" as a measure of library output raises several controversial questions regarding the value of the information. Obviously, most librarians wish to serve as many people as possible but there is a notable reluctance to agree on the precise level at which they will be held accountable. Some library policy makers would be quite satisfied in having, for example, 40% of the community registered for borrowing purposes. Others would feel that 60% was the minimum level in order to justify their existence.

Similar questions arise with regard to the measure "number of individuals who borrow." For example, the library system studied in case 2 has 4075 different and unique individual borrowers who used the library slightly over more than two months. This is more than 10% of the entire community population and could easily be interpreted as a significant number of users. But some would contend that it is an insufficient number and that the library should seek out even higher numbers of users. The question cannot be resolved because definitions of adequacy are not available.

One method for determining adequacy is through comparison of one library with another or others. However, even if comparable figures were available there would be some resistance to such comparisons based on purely value-laden criteria. It is not the purpose of this study to examine the reasons for such values but rather to establish the methodology and

analytical framework for obtaining data that some policy makers will wish to examine.

Finally, the measures that show the percent of individuals who borrow that account for a high percentage of the total circulation will also be subject to conflicting value judgments. In particular, the absolute number of individuals who account for a significant portion of the total circulation may shock or dismay some librarians. For example, 200 individuals may account for 25% to 30% of the total circulation even though 4000 different individuals borrowed materials. But again, the measure is an objective one and descriptive of the state of affairs; not a judgment of what should be.

In the sections that follow, practical applications of the methodology will be explored in some depth. Throughout, the emphasis is on studying use patterns based on the behavior of individuals. Were the data only collected for aggregate groups, much of the analysis that follows would be impossible to perform.

Individual Use by Day of the Week

Since the methodology provides that each visit is coded by day, month and year of the occurrence, these data can be used to establish not only the days of heaviest circulation, but also the variability of use by day of visits, average number of items borrowed per visit, and the individuals served. Trend-line analysis of the data over several months may be performed to establish the difference by day of the week on these variables.

Are there days of the week that generate relatively low total circulation but relatively high numbers of visits by individuals? If such days are selected for reduction of hours, the "impact" would be greater on individual users. This raises the question whether it is the library's mission to circulate books in total or to serve individual users. The same question arises with respect to the closing of branches based on circulation data (see later discussion).

Two concrete examples of the use to which data on individual use as collected by day-of-the-week could be helpful are (1) in the detailed assessment of circulation desk scheduling, and (2) in determining the probable work load necessary to implement an automated circulation system.

Both of these examples are predicated on the observation that there is a built in "overhead" factor to the check-out of material to each patron. Whether an individual checks out one item or many still necessitates that

the circulation desk staff member record the patron number or some other identifying information. If there are problems with the patron (such as an out-of-date card, an accumulation of fines, a record of nonreturn of material or the like), the clerk must make decisions based on the severity of the problem. All this takes time; time that is individual-dependent and not material-dependent. Material-dependent problems emanate from different classes of loan periods, reserve status of materials, and the like. A great deal of staff time is thus consumed in individual-dependent decision-making. The conclusion is that workflow rates (i.e., the number of items that can be processed in a given amount of time) or transaction rates may vary significantly depending on who the individual is. Thus, analyses of total circulation may erroneously reflect on productivity of the work force.

The methodology allows the library analyst to determine not only the total circulation that must be processed by the circulation desk staff but also the number of individuals who account for that circulation. These data can be broken down by day of the week to more closely determine which staff members process what volume of materials and individuals. If one addition is made to the data collection procedures by coding the hour of the day when the transaction takes place or even the individual staff member who checks out the material, very specific work load computations can be made. While this depth of work load analysis may not be viewed enthusiastically by all, the example does illustrate the depth of use of the methodology.

The data also allow certain calculations to be made to assist in the planning for the implementation of an automated circulation control system. Conversion-on-the-fly of the registration of borrowers and the conversion of materials to the new form of the bibliographic database has certain attractive features. A major problem is in anticipating the volume of conversion that will be necessary on a day-to-day basis. Patron registration files can be efficiently converted on-the-fly by utilizing these methods to establish (1) the volume of individuals borrowing per day, (2) the cumulative new borrower rate (the obverse of the repeat rate), and (3) the point at which the new borrower rate bottoms out. Extra equipment needed to cope with the initial surge of new registrants could be planned effectively in advance.

Research could also be conducted to establish the probable rates of problems with patrons that face the circulation staff. This would give staff planners a better assessment of the work volume that will face the staff under a new system. In effect it should be possible to establish a processing rate based on both check-outs and individual borrowers. The result would be a more orderly and efficient plan for the implementation of the new system.[17]

Individual Use of Multiple Units of the Same System

Another outcome of the methodology is the ability to trace individuals who borrow from more than one unit of the same library system. While the limited data available do not permit us to explain why individuals do or do not use other facilities in their same community, such explanations can be inferred from other information such as policies having to do with interbranch delivery, relative proximity of certain units, and the size of the collections. An interesting area of research is present in this type of behavior.

Both library systems studied provided interbranch delivery of materials for patrons who requested such material. Perhaps this explains the findings that in neither system did individuals borrow appreciably from more than one library unit. In case 3, only 1.2% of all borrowers used more than one of the three library units included in the study. In case 2, 8.4% of the borrowers checked out material from more than one library.

Case 2 is of interest because of the inclusion of a bookmobile in the units surveyed. It was felt that in this highly suburban area where the branch library is within three miles of the main library, bookmobile service might show high crossover traffic with one or the other of the two fixed locations. Such was not the case as table 23 indicates.

TABLE 23
PERCENTAGE OF INDIVIDUALS USING ONE LIBRARY UNIT EXCLUSIVELY—CASE 2

	N	*Percentage*
Main branch only	2,431	88.0
Branch only	1,058	78.5
Bookmobile only	247	75.8

Such an analysis suggests that elimination of bookmobile service could lead to the loss of an exclusively used service by certain individuals. Whether or not the individuals who exclusively use a bookmobile could be enticed to use one of the fixed locations if the bookmobile were eliminated is open to question.

And, that same question must be raised when certain branches of a library system are considered for elimination or for drastic reduction of service

hours. Will individuals shift to a new location? A before and after study could be conducted with the methods proposed here to see if individuals who used a now-closed branch shifted to other branches.

Perhaps even more importantly, the methods can be used to establish the number of individuals using various branches. It is not inconceivable (and perhaps highly likely) that certain branches with low total circulation may have larger numbers of individual borrowers than high circulating branches. The result of closing such a low circulating branch may be to eliminate a larger number of individuals than would occur if a higher circulating branch were closed. If such a decision were made, circulation would outweigh individual users in the decision process.

Thus, more detailed research is needed to establish (1) the impact on the number of individuals served by a library unit that is slated for closing, and (2) the probable transfer of these individuals to other library units once their usual library is closed. The methods proposed here allow this type of analysis and should be considered by library planners and decision makers.

Individuals and Reciprocal Borrowing

The concept discussed earlier (that there is an overhead factor that attends every circulation transaction by an individual) is also the basis for the contention that reciprocal borrowing can be approached from a different perspective. Assuming that the findings of this study hold with nonresident borrowers as well as resident borrowers, we would expect that a relatively few individuals account for a high proportion of the loans through reciprocal borrowing.

There are two major points to be made. First, the incidence of all nonresident borrowing will likely be small in relation to the incidence of resident borrowing. Second, if a sizable proportion of the cost of reciprocal borrowing is due to the sending of overdue notices, this cost can be minimized since notices to individuals with multiple overdues can be batched in one notice.

Concerning the first point, the data collected in this study for the case 1 library system suggest that the absolute number of nonresidents utilizing reciprocal borrowing privileges is small—only 3%. Further, just 10.5% on nonresident borrowers accounted for 45.7% of all nonresident borrowing. The subject for further research would be to investigate the incidence of overdue loans to these individuals. A plausable hypothesis would be that overdue behavior is generated by a few individuals and those individuals

are consistent in having material overdue. If this is so, the costs to retrieve material are less than if a great number of people have overdue material. Since notices go only to a few individuals there is consequent savings in postage and supplies. Fewer patrons' addresses must be retrieved thus cutting down on notice preparation. Telephone calls to ask for the return of material will be fewer. In sum, it is possible that a new approach to the funding of reciprocal borrowing might be to reimburse libraries not for items circulated but by individual patrons utilizing reciprocal borrowing services.

Marketing Applications

The idea of marketing library services has become the topic of serious discussion within the past few years. An analysis of the core group concept as a market segmentation device will show how that classification can be used in the identification of target groups within the borrowing population.

Looking again at the basic model:

Core Borrowers	Heavy Borrowers
Heavy Visitors	Light Users

Fig. 3. The Basic Model of Core Groups

We see that each group can be considered to be a "target audience" for which specific programs or stratagies can be devised.

The four core groups symbolize four different behavioral patterns among borrowers. In that three of the groups are small in number, they can be approached in their full magnitude without sampling and with minimum cost. These groups can be targeted with programs to increase their current behavior and they form a ready-made group to approach concerning direct support for library programs, budgets or fund raising. With a known level of interest in library service, the messages can specifically recognize the appreciation of the library's services and call on that support for other and allied services. A mailing list made up of these individuals would be much more efficient than one drawn from a random group of library cardholders

who, as this study shows, would be composed primarily of what we call "light users."

As for the light user group, which is by far the most numerous group, an hypothesis can be raised that this group is very similar to the nonuser group. If this is so, programs that attract the "light users" should have success in attracting present nonusers. The result would be increased use by the entire community.

While the topic of nonuse has not been discussed in this study, it is the author's opinion that increased research on the cause of library use by known users in the type of detail suggested in this study will lead to approaches that will attract nonusers. Research can be fine-tuned through the use of the core group concept to seek out matched pairs of individuals having the same characteristics with the exception of library use. Thus, the efficiency of research can be improved and new areas of investigation launched.

Patron Characteristics

This study has restricted itself to the study of personal characteristics that are readily available in registration files of most libraries, such as gender and residential address. Other libraries may have more extensive information on users—e.g., grade level, date of birth, occupation, educational level, and more.

The collection of additional information on patron characteristics during the registration process can lead to a database that would enhance the type of analysis conducted in this study. However, there is another supplemental approach that can be taken that should yield a richer array of data not only on personal characteristics but also on the attitudes and beliefs of patrons toward library services.

As we have shown, taking 100% of the three highest ranking groups (core borrowers, heavy visitors, heavy borrowers) and a sample of the fourth group, light users, yields a "sample" that is, in effect, three parts a population and one part a sample. Yet the numbers are small in comparison to the total body of borrowers. In place of the use of registration data, this group could be interviewed or questioned by mail, by telephone or in person, depending on the resources available or the need for the control that, for example, personal interviewing provides.

Some of the information that might be gathered in a single *point in time survey* would include:

1. Verification of personal characteristics of the individual who uses the borrower's card. Is this a single user or is the card shared by others? Answers to this question could provide a "correction factor" on user data gathered at the desk. Then, what is the occupation, educational level, personal or family income, age, gender, and so on of the user?
2. Comparison of self-reports of library borrowing behavior with known rates of such behavior. Here one could test perceptions of amount of use from the individual's point of view compared to his/her ranking with respect to other individuals on the known amount of use scale. A person may think that he/she does not use the library often when in fact he/she is one of the library's heaviest users. This may assist in developing an adjustment factor to be applied to survey results to increase their general usefulness.
3. Survey of self-reports of other types of library use. One might take the accuracy of a person's recall of borrowing behavior as a benchmark to determine the probable accuracy of his/her recall on other questions.
4. Opinions concerning the likes and dislikes of individual patrons of aspects of library service, preferences in reading, other sources of information gathering, and specific satisfaction with current or proposed levels of library service. Obviously, there are a multitude of areas of interest that could be examined in this context.

A second approach would be to construct a panel study based on the groups selected above. A panel study has the important advantage of allowing the investigator to examine changes over time. Assuming that the borrowing behavior of individuals would continue to be monitored during the panel study time period, any significant shifts from the individual's previous pattern could be the subject of questioning. Individuals who dramatically increase either their frequency of visiting or their amount of borrowing could be questioned as to the probable causes of that shift in behavior. Similarly, those with decreased rates or even those who have ceased borrowing could likewise be questioned.

A third approach could use an experimental design with all the elaboration that is possible in such studies. A study group could be selected, asked for permission to study its borrowing behavior, and administered controlled effects such as bibliographies, new acquisitions lists, or whatever. The effect (using the appropriate methodology) could be seen in their patterns of borrowing.

It is the existence of data on individual patron borrowing patterns over time that allows us to think in these terms. With the addition of the basic model of the core groups it allows efficiency in the application of these additional investigations.

V. NEW AVENUES FOR FUTURE RESEARCH

Type of Material Borrowed

This study has been concerned with "Who borrows and how much?" A logical extension of the question is "Who borrows what and in what amount?"

Here some serious questions involving individual privacy must be addressed. The current policy is to keep no records that would allow the identification of both an individual and the books that individual checks out. Thus, once the requirements of a library for control of material in circulation are met, the patron record is destroyed or made unavailable. This is particularly true in the present generation of automated circulation control systems.

In libraries operating with manual circulation systems, the patron number continues to be available on the book card so that anyone with access to the registration file can identify the individuals who borrowed a particular book. Where microfilm records are retained, it is also possible to determine who borrowed a particular title. In effect, our current circulation systems are not as privacy protected as we may think.

If we assume that a linking of patron data to titles borrowed can be privacy protected from unauthorized use, and that there are legitimate reasons for library management to have access to general patterns of individual use, some important questions can be addressed.

Obviously, the investigator will want to inspect borrowing patterns of types of material (that is, by subject areas) by different types of patrons including the core groups discussed earlier. Less obvious is an investigation of the total number of individuals who use very specific areas of the collection. We need not know who these individuals are in order to establish that a certain number of individuals who borrowed material in, for example, electronics was greater or less than the particular number of individuals who borrowed material in real estate appraisal. Over the course of a year we could determine the money amount spent on acquiring each of the types of material and calculate a "cost per individual user" for finely divided portions of the collection. Knowing the number of individuals who borrowed in those finely divided areas, we would also have a measure of the collection's "impact" on its user population. We would also have more detailed imformation on the "gaps" in the collection.

Such information gives librarians the ability to make possible decisions as to which areas of the collection to support based on both cost and individual impact. In essence, this concept is directly analogous to the discussion of reducing hours open and the process of closing branches discussed above. The question of values becomes paramount. "Do I supply material for 50 electronics buffs for the same cost that I supply material for 5 real estate appraisal students?" The question is not new but the methodology for making decisions based on incremental elements of the collection is now available.

Borrowing Behavior and Other Library Use

There are many problems associated with determining the use patterns of other library services such as: reference question activity, use of facilities and equipment, casual reading, use of periodical collections, and the like. In a brief exploratory study we attempted to apply this methodology to the question of the relationship between the volume of borrowing to the act of asking questions of staff during the course of a single visit to a library.

The study was carried out in the three library units that comprise case 3. A questionnaire was devised that was handed to each individual who entered the library unit on a specified day. Only one day was chosen for each library unit and thus the findings are not generalizable. Three items on the questionnaire were to be filled in by library staff members when and if the patron borrowed material and/or asked a question. Other information was self-reported by patrons. In addition, the person distributing the questionnaires entered the time of arrival and the time of departure. In this sense, the data were intended not to rely on individual patron initiative for the completion of the questionnaire.

When a patron was ready to check out material, the clerk placed the questionnaire in the charge machine and the patron number was stamped on the questionnaire. The clerk also entered the total number of items borrowed opposite the patron number. Similarly, if a patron asked a question, staff members noted the type of question asked on the patron's questionnaire. Space was provided for multiple questions by patrons.

Table 24 indicates the percentage of patrons who did borrow and did not borrow material on the day of the study. This finding falls well within the limits of previous findings by Clark, et al.[18] in New Jersey, and by DeProspo, et al.[19] nationally.

TABLE 24
PERCENTAGE OF PATRONS BORROWING AND NOT BORROWING MATERIAL

	Main Library	*Branch A*	*Branch B*
Did not borrow	57.6	60.6	43.9
Did borrow	42.4	39.4	56.1
N	(370)	(104)	(82)

In table 25, the results of the analysis indicate that the proportion of patrons who did not ask a question is considerably greater than those who borrowed material. Finally, table 26 indicates the percentage of patrons who neither borrowed material nor asked questions.

TABLE 25
PERCENTAGE OF PATRONS ASKING AND NOT ASKING QUESTIONS

	Main Library	*Branch A*	*Branch B*
Did not ask question	78.6	86.5	54.9
Did ask question	21.4	13.5	45.1
N	(370)	(104)	(82)

TABLE 26
PERCENTAGE OF PATRONS NEITHER BORROWING MATERIAL NOR ASKING A QUESTION

	Main Library	*Branch A*	*Branch B*
No borrowing and no questions asked	47.8	53.8	26.8

The methodology proved to be workable in application and clearly could be utilized in other libraries. In order to etablish trends, a sampling plan would have to be constructed.

Exhaustion of the Collection

A.W. McClellan, in his two books, *The Reader, The Library and the Book* and *The Logistics of a Public Library Bookstock*, introduced this writer to the idea of the importance of the individual borrower of library material.[20] Specifically, McClellan's discussion of "stock exhaustion rate" prompted the writer to explore many of the ideas contained in this work.

McClellan contends that readers may read all the books in a category of their interest and thus cannot read any additional material in that category until the library stock is refreshed with new material. This assumes that readers will not read for a second time material previously read—an assumption that the writer also holds to be true for the vast majority of individuals.

The "Stock Control System" proposed by McClellan is one method of assuring that individuals will find what they want to read in sufficient quantity to maintain their levels of reading. However, the degree to which individuals exhaust one area of the collection and then switch to another or maintain multiple reading interest categories should be the subject of additional research.

In addition to the condition that heavy readers may cease using a particular library because they move or find more pleasing surroundings, readers' "productivity" (or amount of reading) may decrease purely because the library has no more items of interest for them. The replacement rate of new titles in the readers' category of interest may not keep up with their demand. Also, books may not be published in sufficient quantities to satisfy a particular reader.

McClellan's ideas concerning stock control are most appropriate to any investigation of individual use and materials borrowed. We have singled out his comments primarily because of the germ of an idea that he placed in the writer's mind.

Techniques Needed to Study Nonrecorded Use

With the focus of research being on the use patterns of individuals, new techniques will have to be devised to study those areas of library service where the individual leaves no record of his or her actions. Specifically, this would include a student who uses the library only as a study hall and never asks questions, or a person who uses the library's photocopy machine, or the individual who attends a film program. While such uses are beyond the

scope of this study, there is a need for the development of new data-gathering techniques to tap this area of behavior.

The exploratory study described earlier illustrates how to study the relationship between items circulated and questions asked. Observation techniques are another mechanism for gathering data. And, it will probably be necessary to continue to rely upon self-reports by individuals in order to study certain behaviors.

The Potential for Sampling

The three cases described in this study resulted in the recording of 25,085 visits by individuals. It would appear that this methodology would be well suited to some form of sampling procedure in order to reduce the amount of data that need to be coded, entered and processed.

The determination of sample size is a complex problem often demanding that the investigator make estimates of such things as the standard deviation, confidence level, and accuracy. But perhaps more importantly, investigators must understand the level of detail that the analysis will take. If one wants to investigate, for example, the differences between light users who are women and living six or more miles from the library as to their average number of circulations per visit, a sample size must be calculated that allows enough chance for selection of individuals with these characteristics. The sample size will be much smaller for a general analysis of the differences between men and women of their average number of circulations per visit simply because we are now looking at only one attribute (gender) with two attributes (men and women) when before we were looking at a subset of the core groups (light users), a subset of gender (women), and a subset of distance (six or more miles).

All this is by way of saying that sampling is a difficult problem. The desired level of analysis must be determined. Also, one must decide whether or not one wishes to generalize in the purely statistical sense or is interested in a substantive problem.[21] (Cost is another factor. If it costs more to sample than to take the entire population, there should be no hesitation in using the entire population.) Until we are able to test the variability of visiting behavior in different settings, most libraries will find that they must collect data on all transactions for a minimum of two months in order to use the methodology proposed here.

However, if automated circulation systems are available, the potential exists for capturing these data automatically. Software changes in most of

the existing turnkey systems would have to be made to collect the data. Or, some method of transferring information to an offline file would have to be made. Nonetheless, there is an exciting potential in these new systems for exploring the concepts in this study with less effort than would be necessary using a manual system.

Concluding Observations

Investigation of the individual as the analysis unit of library use opens up a myriad of research opportunities. Contrary to the conclusions of Zweizig and Dervin ("the old model of user studies—the identification of who uses the library and how much—has been pushed as far as is helpful...."),[22] this study has shown that there are a number of new and challenging problems in this area. A focus on the individual places the concern of the library in its proper place, and it is hoped that the preceding discussion has paved the way for more intensive and extensive investigation of library service to people.

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